Allegheny County Parks Streams Assessment

Phase 3 Report

North, South, and Boyce Parks

December 2024

Penn State Extension

Allegheny Watershed Steward Program of Allegheny County

TEAM	2021 - 2022 Phase 1	2022-2023 Phase 2	2023-2024 Phase 3
North	Hartwood Acres Park	Deer Lakes Park	North Park
East	Harrison Hills Park	Round Hill Park	Boyce Park
South/ West	White Oak Park	Settlers Cabin Park	South Park

Allegheny County Parks Foundation

PennState Extension

Master Watershed Steward Program

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FORWARD

The following report details the findings of the **Allegheny County Parks Streams Assessment Phase 3** – a cooperative effort among the Allegheny County Parks Department, the Allegheny County Parks Foundation, Allegheny County GIS Department, and the Master Watershed Steward Program of Allegheny County. Funding for this project was provided by the Foundation for PA Watersheds. For additional project description, please refer to the Phase 1 Report.

INTRODUCTION

- Purpose of Project

The current study of streams within the parks assesses the condition of the streams through the assessment of their chemistry, macro-invertebrate biological community, and physical condition using standardized procedures over a one-year period in each park. This process provides a limited baseline for comparison in the future. While a one-year study provides valuable data, it should be noted that a 3 to 5 - year study is recommended for baselines due to yearly fluctuations in weather conditions. This baseline information can be valuable in tracking benefits of site management strategies such as AMD treatment, erosion control measures, etc.

Conducting three types of assessments concurrently provides insight into short-term fluctuations in flows and chemistry, into the long-term stability of the stream channel as it is impacted by weather and land use over decades, and the health of the biological community occupying the stream which is impacted by both long- and short-term conditions.

The purpose of this study is to provide user-friendly information for Parks and Foundation staff and administration to guide decisions in land use, land management, or restoration activities. Toward that end, the Master Watershed Steward program submits its collected data to the county's GIS database so that the data and observations are readily available for review.

In line with the end-goal of enhancing the condition of the parks and visitors' experiences and the environmental quality of the natural resources, specific concerns that were identified and recommendations for addressing them are provided.

- 9 - Park Plan

The streams assessment is being conducted over a three-year period with three parks assessed for one year each. The schedule for assessment of the parks is:

TEAM	2021-2022	2022-2023	2023-2024
North (Team 1)	Hartwood Acres	Deer Lakes	North Park
East (Team 2)	Harrison Hills	Round Hill	Boyce
South/West (Team 3)	White Oak	Settlers Cabin	South Park

PROTOCOLS

Stream assessments can face multiple challenges due to weather. Severely cold conditions can freeze low-flowing streams and/or prevent equipment from operating. Similarly, while high flow events might make conditions unsafe for conducting in-stream activities, dry conditions or leaf-filled channels can make flow/discharge or other measurements impossible.

Physical conditions in or around the stream can also make work hazardous or unfeasible. The presence of extremely dense brush, poison ivy and/or steep slopes or other barriers can make it difficult or impossible for stewards to safely access a stream channel. Safety is the priority of the Master Watershed Steward program and volunteers are encouraged to use their discretion in assessing the conditions in the field with that in mind.

Chemical and biological assessment sites were chosen for several considerations:

- to capture the most impact of park activity & management
- safe to access
- perpetual flow – if possible.

With the help of Braden Meiter, Lead Supervisory Park Ranger for Allegheny County Parks, the Steward Team Leaders selected sites for chemical and macroinvertebrate sampling. While visually assessing each stream and tributary would be ideal, the volunteers were hampered by steep inclines and thickets of thorny berry canes and multiflora rose. Those stream channels that were impassable did not receive any rating.

As in Phase 1, teams captured chemical and biologic data on Samsung tablets with paper record back-up. In Phase 2, the County GIS Team enabled an additional app by the County GIS Team that permits the Master Watershed Stewards to color-code the visually assessed streams. This produces an online map complete with a key to the color-coding indicating overall stream health based on the USDA Stream Visual Assessment Protocol.

- Chemical Assessment

Chemical assessments provide *snapshots* of the condition of the stream at the time of the sampling. Without ongoing monitoring by autonomous electronic probes installed in a stream, sampling captures an intermittent record that provides only a sketch of the performance of a stream as it reacts to weather, chemical impacts from road salt, etc. or land management activity.

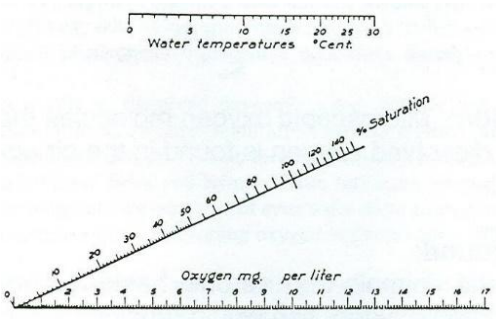
Each of the three teams of Master Watershed Stewards is equipped with Hach "Stream Kits" for measuring temperature, pH, dissolved oxygen, phosphates, and nitrates. "Expert CTS ThermoFisher" conductivity meters and "PCE Instruments" turbidity meters were used to measure those parameters. Flow (discharge) [cubic feet per second] was approximated by measuring the time a float took to travel a section of a stream with a defined/measured cross-section.

Chemical parameters were measured monthly as feasible, with duplicate testing conducted as staffing allowed. As the biological and visual assessments were launched, the time demands of chemical testing led stewards to modify their process as needed. If large disparities were seen, additional runs were conducted as necessary. If tests were not run or considered reliable because equipment was not calibrating correctly, for example, values of 9999 were entered when the database required a value to be recorded. If entered in the data, questionable values are denoted on a pink or blue field – see notes that accompany each table.

Chemical Parameters for Healthy Streams

- pH: Most aquatic organisms have adapted to survive in water that has a pH range between 6 and 9 but sensitive species prefer 6.5 – 7.5**.** The pH of the environment influences the ability of biological and chemical processes to function effectively.

- Dissolved Oxygen (DO): Dissolved oxygen in a stream may vary from 0 – 18 mg/L. DO is inversely proportionate to temperature: colder water can hold more dissolved oxygen than warm water. Water can be "super saturated" with oxygen.



To determine percent saturation: Multiply your DO level (mg/L) by an atmospheric pressure correction factor.

Elev. 542-1094 = .98 factor

Elev. 1094-1688 = .96 factor Find this corrected DO level on the bottom horizontal line and draw a straight line to connect to the water temperature (top line).

Source: Allegheny College Creek Connections

Dissolved oxygen gets into water by contact with the atmosphere, through aeration in turbulent areas, and through photosynthesis of aquatic plants. It is consumed during normal metabolic functions of aquatic organisms but can be depleted if excessive nutrients disrupt the balance and cause an excess of plant growth followed by decay. Dissolved oxygen levels in natural aquatic systems follow daily and seasonal cycles.

Range of Tolerance for Dissolved Oxygen in Fish										
mg/L dissolved oxygen										
0	1	2	3	4	5	6	7	8	9	10…
<3.0 mg/L too low for fish populations			3.0 – 5.0 mg/L 12-24 hr. range of tolerance/ stressful condition			6.0 mg/L supports spawning	> 7 ppm Supports growth/activity	>9 mg/L Supports abundant fish populations		

Adapted from the Water Research Center

Most aquatic organisms need at least 5 mg/L of dissolved oxygen to survive. Different aquatic insects and fishes have different oxygen demands. For example – some Northern Pike, a cold-water fish, require 6.0 mg/L DO and Black Bullhead catfish only need 3.3mg/L to survive. An animal's oxygen demands can change with environmental conditions. For example, a trout requires six times more DO at 75 degrees Fahrenheit compared with 41degrees Fahrenheit due to higher metabolic demands.

- Phosphate (Orthophosphate): Most unpolluted streams have levels below 0.03 mg/L. Phosphate levels can be elevated by fertilizer or detergent entering a stream through run-off or attached to sediment washed into the stream.
- Nitrate: Unpolluted waters have nitrate levels below 4.4 mg/L. Nitrate is another pollutant related to fertilizer or animal waste entering the stream. Both Phosphate and Nitrate can contribute to elevated algae growth which can deplete DO if/when killed off by low water levels or cold weather.

The Hach nitrate test uses a colorimetric measurement, comparing a treated sample to an untreated one. The amount of nitrate is indicated by the presence and intensity of a pink coloration in the test sample. Chloride is an oxidizing agent and disrupts the test by producing a peach/orange tone. Tests with that result are voided and recorded as 9999 -- an invalid score.

- Conductivity: Conductivity is the measurement of the ability of water to conduct a current and is an indicator the number of ions in a stream, such as those produced by road salt or other ionizing compounds entering the stream and going into solution. According to the EPA, inland fresh-water streams that support good mixed fisheries range from 150 -500 mS/cm (microsiemens per centimeter.)

- Turbidity is an optical measure of the clarity of water which can be impacted by solids suspended in the water column. The lower the NTU (nephelometric turbidity units) value for turbidity, the clearer the water.

  High levels of turbidity can affect stream health by warming the stream, thus reducing Dissolved Oxygen levels and promoting algal growth. Furthermore, sediment can transport pollutants into the stream. Suspended materials can clog fish gills and affect egg and larval development. If the particles settle and blanket the stream bottom, they can smother fish eggs and benthic macroinvertebrates.

- Visual Assessment

The physical condition of streams was scored using the USDA's Stream Visual Assessment Protocol. This protocol prescribes a 10 – 1 (best – worst) score for attributes of:

- Water appearance (clear, cloudy, discolored, or filmy)
- Channel condition (extent of manmade alteration or armoring)
- Bank stability (presence or severity of erosion)
- Embeddedness (extent of sediment deposition on stream floor)
- Fish barriers (presence of man-made barriers to fish movement up/downstream)
- In-stream fish cover (types of shelter from predators)
- Invertebrate habitat (types of structure for egg-laying and sheltering)
- Riparian zone (condition of streamside vegetation)
- Canopy cover (extent of shade by forest vegetation)
- Nutrient enrichment (indication of excess algae or other growth)

The presence of any indication of AMD (abandoned mine drainage), manure, or sewage is captured as well.

A score of 10 would be the condition met in an undisturbed forest stream with a healthy trout population, while a 1 would be a concreted drainage canal in California. *Segments* are areas that have consistent overall character and land use around them. Scores are based on the overall score for the segment's condition, recognizing that some specific areas might differ, which is recognized in the scoring parameters. (See Bank Stability example below.)

Bank Stability										
Banks are stable; at elevation of active flood plain; 33% or more of eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation.			Moderately stable; at elevation of active flood plain; less than 33% of eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation.				Moderately unstable; banks may be low, but typically are high (flooding occurs 1 year out of 5, or less frequently); outside bends are actively eroding (overhanging vegetation at top of bank, some mature trees falling into stream annually, some slope failures apparent).		Unstable; banks may be low, but typically are high; some straight reaches and inside edges of bends are actively eroding as well as outside bends (overhanging vegetation at top of bare bank, numerous mature trees falling into stream annually, numerous slope failures apparent).
10	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**	**1**

Photographs were taken of notable features or conditions within the stream channel and at waypoints designating segment start- and endpoints.

- Biological Assessment

Biological assessments survey the living aquatic community of a waterbody. Several techniques are available for this process. A common one was applied here to inventory the types of benthic (bottom-dwelling) macroinvertebrates (animals lacking vertebral columns that can be see without a microscope). These can include crayfish, clams, snails, aquatic worms and leeches, and an array of insects' larval stages. Because all these organisms spend extended periods to all their lives in the water and have recognized tolerance levels to water conditions, they provide a gauge of the conditions of a stream over a long period. Benthic macroinvertebrate insects are generally less than one inch in length, and most have external gills that are vulnerable to sediment and chemical disruption. They provide the primary food source for many fish and other aquatic life and are valuable in breaking down organic debris entering the stream. Sensitive species native to streams in southwest Pennsylvania generally prefer sediment-free rocky bottoms in flowing streams where they have high levels of oxygen and can be safe from predation. Macroinvertebrate insect populations generally peak in the spring and fall as over-wintering species or summer-maturing species are approaching "emergence" as flying adults. Surveys are generally conducted during spring and fall months.

Macroinvertebrate surveys were conducted using a 1mX1m kick net which is anchored in the bottom of the stream. A 1- meter square area of substrate immediately upstream of the net is "kicked" (disturbed) for a set length of time to flush animals into the net. Sampling is done in different types of habitats to identify animals with different feeding and habitat preferences. Animals captured were scored using the "Hoosier Riverwatch Biological Monitoring" score sheet which weighs each taxonomic order present based on their sensitivity to pollution and generates a Pollution Tolerance Index (correlated to water quality) of "poor", "fair", "good", or "excellent". The scoring system applied does not address individual counts for each taxonomic Order but provides an appropriate level of assessment for this study.

- Quality Assurance and Control

Duplicates run at each assessment for dissolved oxygen were prioritized as this parameter is key for determining invertebrate viability in a stream. Year-end scrutiny of results provided an opportunity to identify gaps and irregularities in the on-line data and allowed for correction or explanation of the posted results. See notes under Chemical Assessment above regarding the validity of data.

RESULTS – YEAR 3

- GIS Data map:

All data and photo images for the three parks studied are available at the following interactive link.

https://alcogis.maps.arcgis.com/apps/dashboards/de70025d4c8943d383d6e266dd8579dd

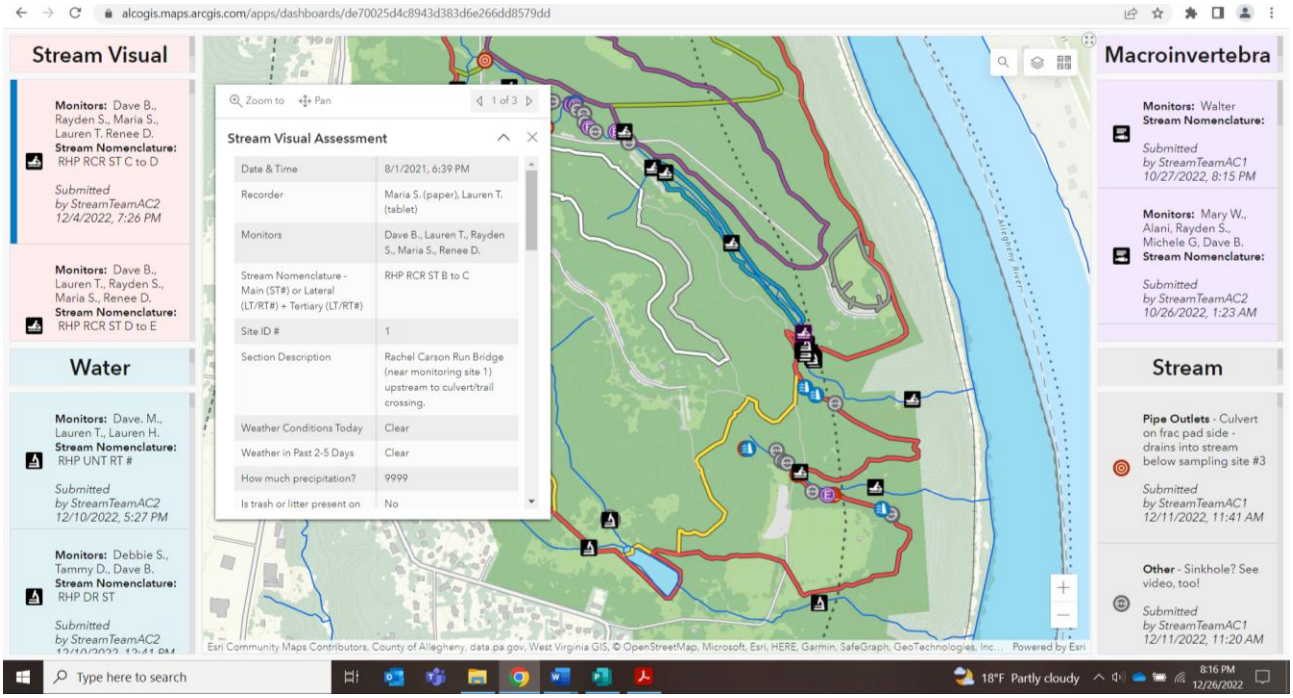
**** This website is not currently intended for public access. ****

You will need to log onto an ARCGIS account to access the link above. Using the cursor, you can drag the map image to the park in question and then use the + and – buttons to zoom in or out on the map.

The side panels of the dashboard display the different icons corresponding to the different assessments conducted. Icon locations indicate where the data was captured. To reveal the data or photograph for that location, click on the data point. Photographs or waypoints may be coded for the type of image content captured such as erosion, debris jam, outflow, etc.

A new mapping tool has been developed that allows teams to color code segments of streams based on their score in the visual assessment. Captured images from this too are included in this report.

NOTE: The GIS Department staff would like to modify the map format for external viewers in the future with input from prospective viewers. The format seen below is active for the current data set.



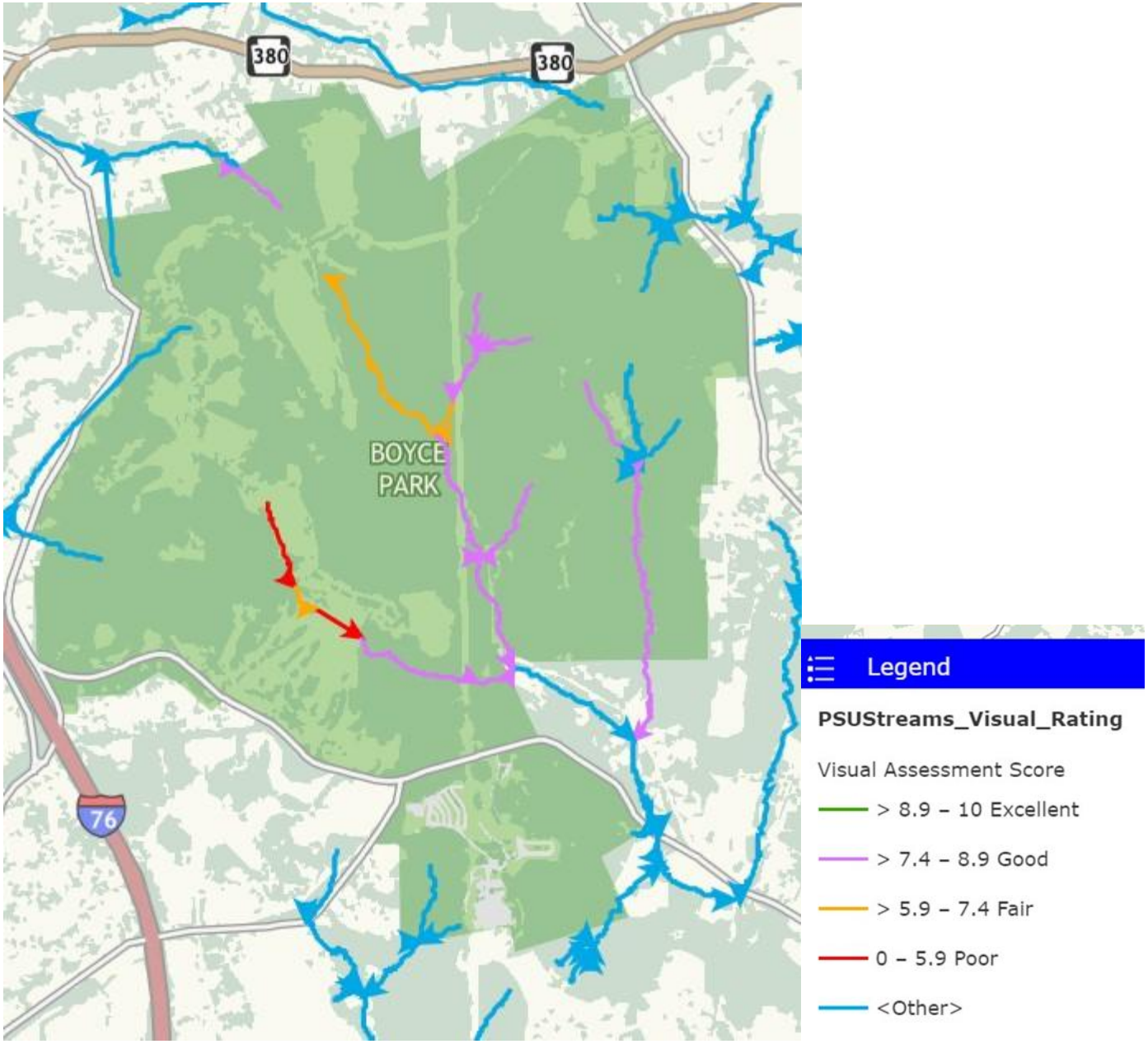
Results for each park are captured here in four components:

- Screen shot of the GIS-based map with icons indicating photographs and type of data available
- Chemical Assessment: Tabulated data for the principal parameters assessed

- Physical Assessment: Tabulated data for the 13 parameters within the scoring protocol and final score
- Biological Assessment: Tabulated results for the presence/absence of 22 benthic macroinvertebrate Orders surveyed and final score of Pollution Tolerance Index

BOYCE PARK AGGREGATED DATA POINTS

Boyce Park - STREAM RATINGS MAP



Boyce Park - VISUAL ASSESSMENT RESULTS

Date	Section Description	Channel condition	Riparian zone	Bank stability	Water appearance	Nutrient enrichment	Fish barriers	In-stream fish cover	Embeddedness	Insect/Invertebrate habitat	Canopy cover	Acid Mine Drainage (if applicable)	Sewage (if applicable)	Manure presence (if applicable)	Total_score
Jan-24	UNT to Pierson Run Ski Slope-between two culverts also flattens w/wetlands	8	8	8	8	9	5	9	8	8	7	3			7.7
Jan-24	UNT to Pierson Run Ski Slope -ski hill culvert	1	1	9	7	8	1	1	9	1	7	3			4.4
Jan-24	UNmapped UNT to UNT to Pierson Run Ski Slope	8	9	8	8	8	8	6	8	8	9				8.3
Jan-24	UNT1LT1 to Pierson Run Ski Slope	8	8	8	10	8	5	8	9	9	7	3			8.3
Mar-24	Main Stem Pierson Run (downstream end)	8	9	8	9	8	5	9	9	8	8	4			7.7
Apr-24	UNT to Pierson Run - Woods	9	9	8	9	9	8	8	9	8	9				8.6
Apr-24	UNT to UNT to Pierson Run- Woods (left)	8	9	8	9	9	6	8	8	7	9				8.1
Jun-24	UNT to Pierson Run - Power Lines - AMD (downstream of wetland)	8	8	8	9	7	8	8	8	8	8				8.0
Jun-24	UNT to Pierson Run - Power Lines -Wetland	7	7	8	9	7	6	8	8	8	7				7.5
Jun-24	Powerlines (upstream of wetland (right))	8	8	8	9	8	6	8	8	8	8				7.9
Jul-24	Main stem Pierson Run headwaters flows south (upstream end)	8	8	8	9	7	6	9	8	8	7	3			7.4
Sep-24	UNT to Pierson Run Ski Slope - Wetland	3	7	9	9	9	7	5	8	8	7	5			7.0
Sep-24	UNT to Pierson Run Ski Slope - AMD ponds	2	5	9	5	6	1	7	5	9	7	5			5.5
Sep-24	Unmapped UNT to UNT to Pierson Run Ski Slope	7	7	7	8	8	5	8	7	8	7				7.2
Sep-24	Pierson Run? Headwaters flows north	8	9	8	9	8	7	8	8	8	9				8.2
Sep-24	UNT to Pierson Run (log cabin parking lot)	9	9	8	9	8	5	8	8	8	9				8.1
< 6.0	Poor														
6.1-7.4	Fair														
7.5-8.9	Good														
> .9.0	Excellent														

Boyce Park - CHEMICAL ASSESSMENT RESULTS

Date	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
SITE 1 NEAR PIERSON RUN ROAD AT SOUTHEAST CORNER OF PARK																				
8/19/2023	Clear	0	Clear	0.45	65	68	57	57	11	11	0	0	0	0	650	650	7.1	7.2	10.15	8.39
9/23/2023	Clear	0	Clear	0.12	59	59	52	52	10	10	0	0	0	0	740	760	7.1	7.7	0	0
10/6/2023	Showers		Overcast	0.33	67	67	58	58	10	10	0		0	9999	620	650	7	7.1	0.38	0.2
11/11/2023	Rain	0.18	Rain	0.23	41	41	40	40	12	12	0		0	9999	720	730	7	0.12	0.11	0.12
12/9/2023	Clear		Rain	0.36	52	52	38	38	14	14	0.64	0.68	0	9999	710	680	6.9	6.4	0	0.33
1/13/2024	Rain		Snow	2.35	32	32	38	38	15	14	0		0.05	0.05	500	500	6.7	7	6.91	10.1
2/10/2024	Rain	0.01	Clear	1.6	53	53	42	42	13	13	0		0.22	0.22	730	730	6.6	7	9.51	9.03
3/9/2024	Rain	0.25	Rain	3.5					13	15	0		0.22	0.22	570	570	6.4	6.7	30.82	30.91
4/20/2024	Rain		Clear	2.53	51	51	52	52	9	10	0		0	9999	780	790	4.5	4.5	11.17	18.07
5/4/2024	Rain		Overcast	1.07	62	62	60	60	13	13			9999	9999	710	700	4.6	5.4	24.34	24.72
6/15/2024	Rain	0.25	Clear	0.34	65	65	58	58	8	7	0		0.22	0.22	9999	9999	6.9	7.4	1.56	0.96
7/27/2024	Clear		Clear	0.13	75	75	64	64	9	9	0		0	9999	820	830	6.2	6.1	0	0.39

Note: Values highlighted pink are outside normal range

Boyce Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
SITE 2 UPPER SAMPLING SITE NEAR PIERSON RUN ROAD																				
8/19/2023	Clear	0	Clear	0.08	71	71	62	62	10	10	0		0	9999	970	1010	4.5	4.5	7.07	9.99
9/23/2023	Clear	0	Overcast	0.08	60	60			10	10	0		0	9999	1290	1290	4.3	4.4	29.2	33.66
10/6/2023	Rain		Overcast	0.1	66	66	51	51	10	10	0		0	9999	1150	1120	4.6	4.5	7.23	4.83
11/11/2023	Clear	0.18	Clear	0.03	43	43	38	38	14	14	0		0	9999	1190	1120	4.4	4.6	5.72	18.28
12/9/2023	Overcast		Rain	0.07	56	56	39	39	10	10	0		0	9999	1080	1130	5	4.8	37.77	79
1/13/2024	Rain		Snow	0.32	38	30	11	38	13	11	30		0	9999	830	790	0	4.95	4.85	18.71
2/10/2024	Rain	0.10	Clear	0.33	49	49	46	46	12	11	0		0	9999	1100	1120	4.8	4.3	1.9	0.54
3/9/2024	Rain		Rain	1.47	48	48	48	48	14	13	0.2	0.24	0	9999	620	670	5.1	4.9	49.8	76
4/20/2024	Rain	0.25	Clear	0.46	54	54	52	52	13	13	0		0	9999	1210	1230	3.5	3.5	0.24	0.31
5/4/2024	Rain		Overcast	0.51	62	62	59	59	14	12			9999	9999	1130	1170	3.9	3.9	0.23	0.48
6/15/2024	Rain	0.25	Clear	0.16	60	60	68	68	11	11	0		0	9999	9999	9999	3.9	3.8	9.98	11.03
7/27/2024	Clear	0	Clear	0.03	76	76	65	65	11	11	0		0.22	9999	1410	1400	4.2	4.2	26.01	4.7

Note: Values highlighted pink here are outside normal range or show a large discrepancy between Sample A and Sample B

Boyce Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
SITE 3 NEAR SPRING MILLER ROAD																				
8/19/2023	Clear	0	Clear	0.11	67	67	59	59	9	9	0		0	9999	1010	990	7.5	7.7	1.16	0.5
9/23/2023	Clear	0	Clear	0.4	59	59	58	58	10	9	0	0	0	9999	1080	1080	7.7	7.8	0.99	0.54
10/6/2023	Showers		Overcast	0.63	67	67	58	58	11	11	0		0	9999	980	1010	7.1	7.2	2.31	1.51
11/11/2023	Rain	0.18	Clear	0.08	42	42	40	40	11	11	0		0	9999	1040	1050	7	7.1	0	0
12/9/2023	Overcast		Overcast	0.19	53	53	42	42	13	9999	0		0	9999	890	860	6.9	6.3	0	0
1/13/2024	Rain	0.3	Rain	3.28	30	30	35	35	13	14	0	0	0.44	0.22	910	880	7.4	7.4	9.65	11.08
2/10/2024	Rain	trace	Overcast	0.94	53	53	42	42	14	14	0		0.22	0.22	850	870	6.5	6.8	8.14	6.15
3/9/2024	Rain		Rain	8.8	48	48	46	46	14	14	0		0.22	0.22	650	650	6.3	6.7	35.42	32.88
4/20/2024	Rain		Clear	3.07	53	53	54	54	13	12	0		0	9999	920	950	4.7	4.9	34.64	35.45
5/4/2024	Rain		Overcast	1.2	62	62	63	63	11	11			9999	9999	970	950	5.4	5.5	19.29	19.75
6/15/2024	Rain	0.25	Clear	0.79	64	64	62	62	6	6	0		0.22	9999	9999	9999	6	6.1	0.95	0
7/27/2024	Clear		Clear	0.21	76	76	64	64	11	11	0		0.22	9999	1260	1260	6.1	6.4	0	0

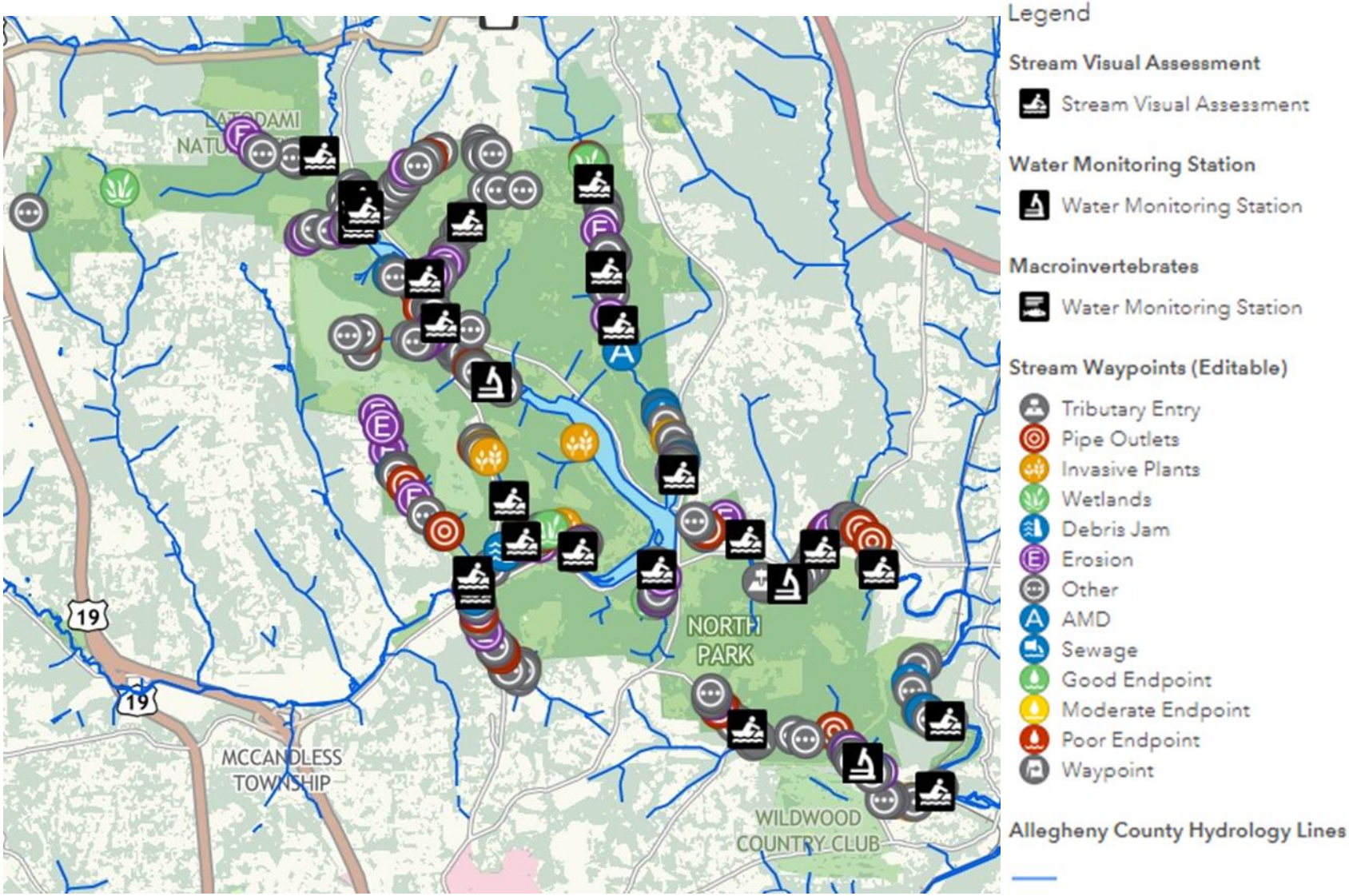
Boyce Park – BIOLOGICAL ASSESSMENT RESULTS

Date	Site ID #	Are Stonefly nymph present?	Are Mayfly nymph present?	Are Caddisfly larva present?	Are Riffle Beetle present?	Are Dobsonfly larva present?	Are Right-handed or Gilled Snail present?	Are Water Penny present?	Number of Group 1 TAXA represented (Intolerant)	Are Damselfly nymph present?	Are Dragonfly nymph present?	Are Scud present?	Are Sowbug present?	Are Cranefly larva present?	Are Clam/Mussel present?	Are Crayfish present?	Number of Group 2 TAXA represented (Moderately Intolerant)	Are Leech present?	Are Midge larva present?	Are Planaria/Flatworm present?	Are Black fly larva present?	Number of Group 3 TAXA represented (Fairly Tolerant)	Are Aquatic worm present?	Are Blood midge larva (red) present?	Are Rat-tailed Maggot present?	Are Left-Handed or Pouch Snail present?	Number of Group 4 TAXA represented (Very Tolerant)	Pollution Tolerance Rating
Oct-23	1	Yes	No	Yes	No	Yes	No	Yes	4	Yes	Yes	No	No	No	No	Yes	3	No	No	No	Yes	1	No	No	No	No	0	27
Oct-23	2	Yes	No	Yes	No	Yes	No	No	3	No	No	No	No	No	No	No	0	No	No	No	No	0	No	No	No	No	0	12
Oct-23	3	No	Yes	Yes	No	No	No	No	2	No	Yes	Yes	No	No	No	No	2	No	No	No	No	0	No	No	No	No	0	14
Apr-24	1	Yes	No	Yes	No	No	No	No	2	No	Yes	No	No	Yes	No	No	2	No	No	No	Yes	1	Yes	No	No	No	1	17
Apr-24	2	No	No	No	No	No	No	No	0	No	No	No	No	No	No	No	0	No	No	No	No	0	No	No	No	No	0	0
Apr-24	3	Yes	No	Yes	Yes	No	No	No	3	No	Yes	No	Yes	Yes	No	Yes	4	No	Yes	Yes	Yes	3	Yes	No	No	No	1	31

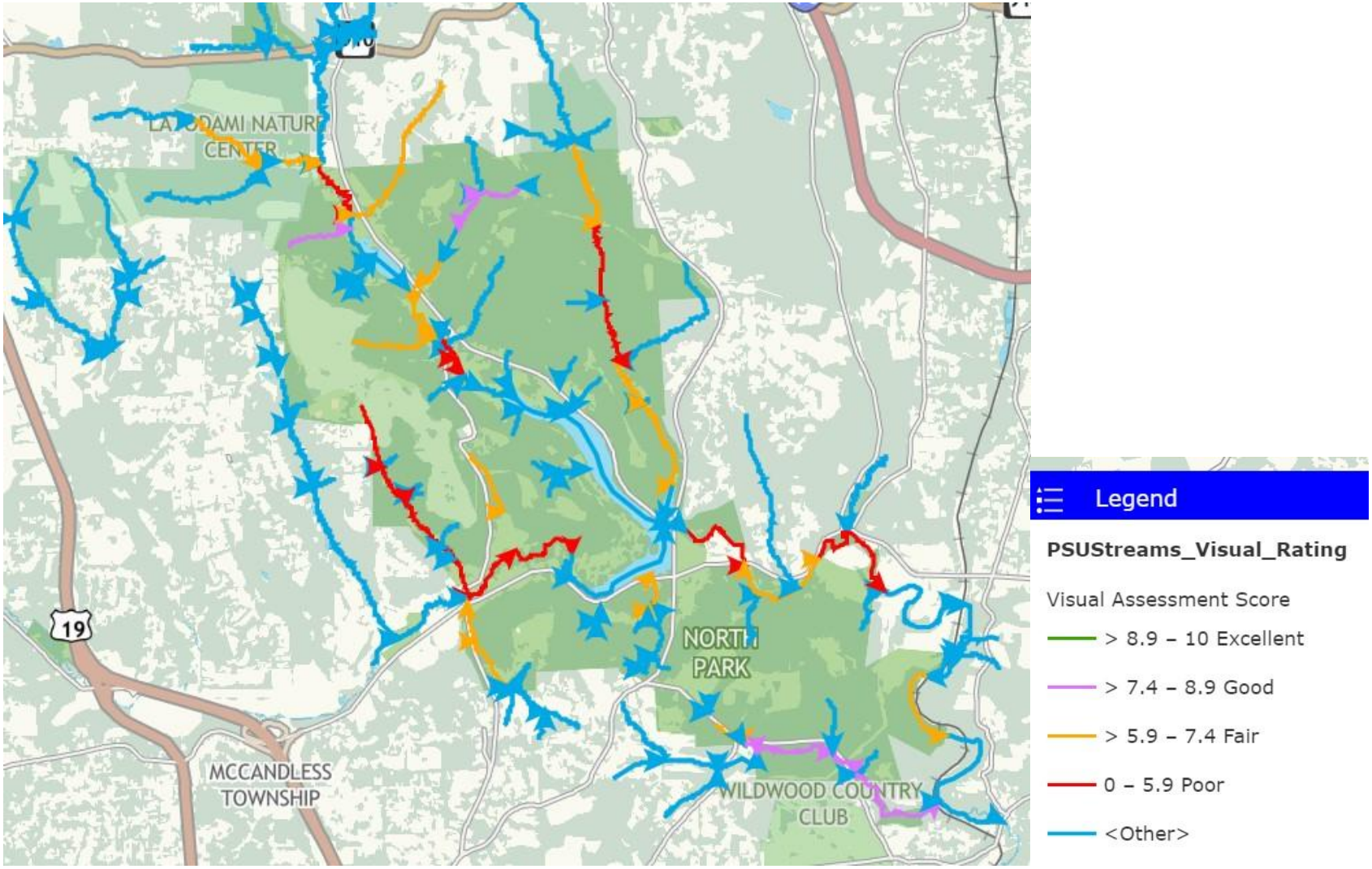
Pollution Tolerance Index Ratings	
23 or more	Excellent
17-22	Good
11-16	Fair
10 or less	Poor

Note: Site 2 is heavily impacted by abandoned mine drainage.

NORTH PARK AGGREGATED DATA POINTS



NORTH PARK - STREAM RATINGS MAP



North Park - VISUAL ASSESSMENT RESULTS

Date	Section Description	Channel condition	Riparian zone	Bank stability	Water appearance	Nutrient enrichment	Fish barriers	In-stream fish cover	Embeddedness	Insect/Invertebrate habitat	Canopy cover	Acid Mine Drainage (if applicable)	Sewage (if applicable)	Manure presence (if applicable)	Total_score
Jun-24	Reach 1: Irwin Run from entrance to lake to the end of the badly eroded reach	5	9	1	9	9	10	7	3	7	8	0	0	0	6.8
Jun-24	Reach 2: Irwin Run	5	4	1	8	6	5	7	8	9	1	3	0	0	5.18
Jun-24	Reach 3: Irwin Run	5	5	1	8	6	5	6	8	8	2	0	0	0	5.4
Jun-24	Reach 4: Irwin Run from where the dead trees stopped and the wetland turned to solid footing up to the conservation area	4	7	2	8	5	10	6	8	8	3	0	0	0	6.1
Jun-24	Pine Creek: midway from beginning of lake to Kummer Road	2	9	2	5	4	10	6	6	8	3	0	0	0	5.5
Jun-24	Pine Creek: from beginning of lake to about halfway to Kummer Road	4	9	5	3	9	10	4	1	4	6	0	0	0	5.5
Sep-24	from swimming pool parking lot to just above the housing plan on Peebles Road	2	3	2	9	9	1	2	5	2	3	0	0	0	3.8
Sep-24	from Pine Creek to where stream exits Towne Square Drive housing plan via culvert	8	10	7	10	9	1	7	7	10	9	0	0	0	7.8
Sep-24	from Walter Road up to where Kummer intersects with Green Brier Drive	1	3	3	9	8	1	4	9	9	3	0	0	0	5
Sep-24	**above** football field	4	9	8	9	10	10	5	9	9	3	5	0	0	7.36
Sep-24	stream that runs through Latodami	5	9	7	8	9	1	7	9	8	3	0	0	0	6.6
Sep-24	North Fork Pine Creek above Lake Marshall	3	9	5	3	7	1	7	3	9	5	0	0	0	5.2
Sep-24	stream that empties into North Fork Pine Creek near skating rink	4	9	6	9	8	5	10	9	9	4	0	0	0	7.3
Sep-24	**above** maintenance facility	8	9	9	9	9	10	8	9	9	9	0	0	0	8.9
Sep-24	**below** maintenance facility	5	3	3	9	9	10	7	9	8	5	0	0	0	6.8
Oct-24	Pine Creek from bridge over Wildwood Road to Alleg County Maint Facility Bridge	3	7	6	9	5	5	7	7	8	5	0	0	0	6.2
Oct-24	Pine Creek from Allegh Co Maint Facility to where the creek exits the park property	4	3	3	9	8	9	5	6	8	2	0	0	0	5.7
Oct-24	Pine Creek along RR tracks at southeast border of N Park	7	9	8	8	7	9	5	7	7	4	5	5	0	6.75
Oct-24	trib starts above Old Ingomar Road and flows to lake near "The Cabin"	9	8	9	9	9	4	5	4	9	4	0	0	0	7
Oct-24	along Kummer Road. Reach starts at intersection of Kummer and E Ingomar Road to park boundary near Foxgrove Lane	5	7	7	9	9	2	9	8	9	7	0	0	0	7.2
Oct-24	from spillway to end of park boundary near Mansion Drive	2	8	9	3	9	5	3	6	5	2	0	0	0	5.2
Oct-24	this stream drains the golf course	4	9	2	9	9	9	7	9	9	6	0	0	0	7.3
Oct-24	flows from golf course side of park and flows to North Fork Pine Creek at the skating rink	9	9	4	9	9	9	7	8	9	9	0	0	5	7.9
< 6.0	Poor														
6.1-7.4	Fair														
7.5-8.9	Good														
> .9.0	Excellent														

North Park - CHEMICAL ASSESSMENT RESULTS

Date & Time	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
NORTH PARK SITE 1 IRWIN RUN																				
8/20/2023	Clear	0.00	Clear	0.58	66	66	60	60	10	10	0		0.22	0.22	490		7.9		3.91	
9/17/2023	Clear	0.00	Clear	0.425	57	57	60	60	12	12	0.04	0.04	2.2		600		8.2		12.27	
10/15/2023	Showers	0.61	Overcast	0.393	48	48	49	49	9	9	0.04		0		520		8.1		17.62	
11/12/2023	Clear	0.00	Clear	0.327	42	42	40	40	12	12	0.2		0		650		8.5		17.18	
12/10/2023	Rain	0.06	Overcast	0.644	44	44	48	48	11	11	0	0	0.66		510		8.1		17.52	
1/27/2024	Rain	0.66	Overcast	18.58	56	56	48	48	11	11	0.04		0.88		410	400	7.7		24.89	
2/23/2024	Rain	1.16	Clear	5.07	48	48	44	44	12	11	0.08		0.66	0.66	610		8.1	8	14.16	
3/24/2024	Rain	0.15	Overcast	5.28	38	38	42	42	13	13	2	2	1.54		480		8.1		17.11	
4/28/2024	Rain	0.07	Overcast	0.68	70	70	56	56	13	13	0		0.88		440		7.9		1.94	
5/28/2024	Rain	0.10	Clear	0.624	63	63	59	59	10	10	0		0.88		410		8.5		2.04	
6/24/2024	Rain	0.32	Clear	0.187	70	70	70	70	8	8	0		0.22		120		8.5		23.4	
7/19/2024	Clear	0.00	Clear	0.056	61	61	64	64	7	7	0.2	0.2	0	0	570		7.9		0.65	

North Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date & Time	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
NORTH PARK SITE 2 ROCKY DELL																				
8/20/2023	Clear	0.00	Clear	1.474	75	75	66	66	11	11	0.18	0.18	0.968		850		7.9		5.84	
9/17/2023	Clear	0.00	Rain	1.046	61	61	60	60	11	11	0.12		1.1		850		8.2		14.84	
10/15/2023	Rain	0.61	Overcast	1.278	51	51	51	51	11	11	0.04		0.22	0.22	760		8.2		14.12	
11/12/2023	Clear	0.00	Clear	0.968	44	44	42	42	14	14	0.08		0.22		830		8.7		16.77	
12/10/2023	Rain	0.06	Overcast	1.712	44	44	48	48	12	12	0	0	0.66		750	740	8.3		22.42	
1/26/2024	Rain	0.66	Overcast	9.09	60	60	49	49	11	11	0.04		1.1		1170		7.9			
2/24/2024	Rain	1.16	Clear	4.44	54	54	46	46	13	13	0.04		1.1		1360		8.1		6.31	
3/24/2024	Rain	0.15	Overcast	3.45	42	42	42	41	14	14	0		1.32		780		7.9	7.9	16.38	
4/28/2024	Rain	0.07	Overcast	3.97	70	70	61	61	11	11	0.04		0.66	0.66	650		8.2		2.89	
5/28/2024	Rain	0.10	Clear	3.034	63	63	61	61	10	9	0.04		1.54		650		8.3		0.32	
6/24/2024	Rain	0.32	Clear	0.845	69	69	69	69	8	8	0		0.88		600		8.1		2.38	
7/19/2024	Clear	0.00	Clear	1.2	64	64	62	62	8	8	0.16	0.16	0.88		740		8.3		0.84	

North Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date & Time	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
NORTH PARK SITE 3 WILDWOOD ROAD STREAMBANK RESTO AREA																				
8/20/2023	Clear	0.00	Clear	25.62	68	67	70	70			0	0	0.528		560		8.3		9.86	
9/17/2023	Clear	0.00	Rain	11.72	61	61	69	69	10	10	0		1.54		610		7.9		12.53	
10/15/2023	Rain	0.61	Overcast	14.368	52	52	59	59	11	11	0		0.22		770		8.2		4.82	
11/12/2023	Clear	0.00	Clear	7.12	46	46	44	44	10	10	0.04		0.22	0.22	830		8.2		12.37	
12/10/2023	Rain	0.06	Overcast	26.166	45	45	43	43	13	13	0	0	1.1		540		8		14.07	
1/26/2024	Rain	0.66	Overcast	**TH**	62	62	52	52	11	11	0.04		1.32		1540		8.1		35.65	
2/23/2024	Rain	1.16	Clear	84.394	48	48	44	44	13	13	0.04		1.1		1160		8.3		12.02	
3/23/2024	Rain	0.15	Overcast	53.37	38	38	43	43	14	14	0		1.54	1.54	790	780	8.1	8	9.69	
4/28/2024	Rain	0.07	Overcast	28.89	72	72	72	72	11	11	0.04	0.04	0.1		510		7.9		5.41	
5/28/2024	Rain	0.10	Clear	39.38	64	64	68	68	9	9	0.04		1.1		510		8.1		2.36	
6/24/2024	Rain	0.32	Clear	19.676	76	76	75	75	7	7	0		0.66		700		8.2		1.7	
7/19/2024	Clear	0.00	Clear	7.11	66	66	75	75	7	7	0.1		0.22		680		7.9		0.06	

Note: TH indicates the water level was too high for the assessors to take measurements safely.

North Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date & Time	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
NORTH PARK SITE 4 TENNIS COURTS BELOW WATERFALL																				
8/31/2023	Clear	Trace	Rain	12.44	69	69	68	68	10	10	0.02		0.22		700		7.8		0.38	
9/17/2023	Clear	0.00	Overcast	5.98	72	72	65	65	10	10	0		0.22		660		7.9		17.81	
10/15/2023	Showers	0.61	Overcast	6.446	55	55	54	54	10	10	0.04		0	0	790		8		8.53	
11/12/2023	Clear	0.00	Clear	2.15	46	46	48	48	11	11	0.04		0.22		760		8.2		2.33	
12/11/2023	Rain	0.06	Rain	8.252	42	42	46	46	13	13	0	0	0	0	840		8		9.72	
1/26/2024	Rain	0.66	Overcast	125.29	60	60	44	44	11	11	0	0	0.88		980	980	8.1		44.07	
2/23/2024	Rain	1.16	Clear	29.3	48	48	44	44	13	13	0.04		1.32		1460		8.1		18.44	
3/23/2024	Rain	0.15	Overcast	34.48	38	38	44	44	14	14	0		1.98		800		8.1	8	8.03	
4/28/2024	Rain	0.07	Overcast	11.1	76	76	64	64	12	12	0		0.068		570		7.7		16.15	
5/28/2024	Rain	0.10	Clear	23.11	65	65	68	68	9	9	0		1.1		480		7.9		1.84	
6/24/2024	Rain	0.32	Clear	1.09	77	77	78	78	8	8	0	0	0.44		660		7.9		7.6	
7/19/2024	Clear	0.00	Clear	3.74	68	68	68	68	7	7	0		0	0	640		7.9		6.62	

Note: Water volume in all streams was high on 1/26/2024 due to recent rains.

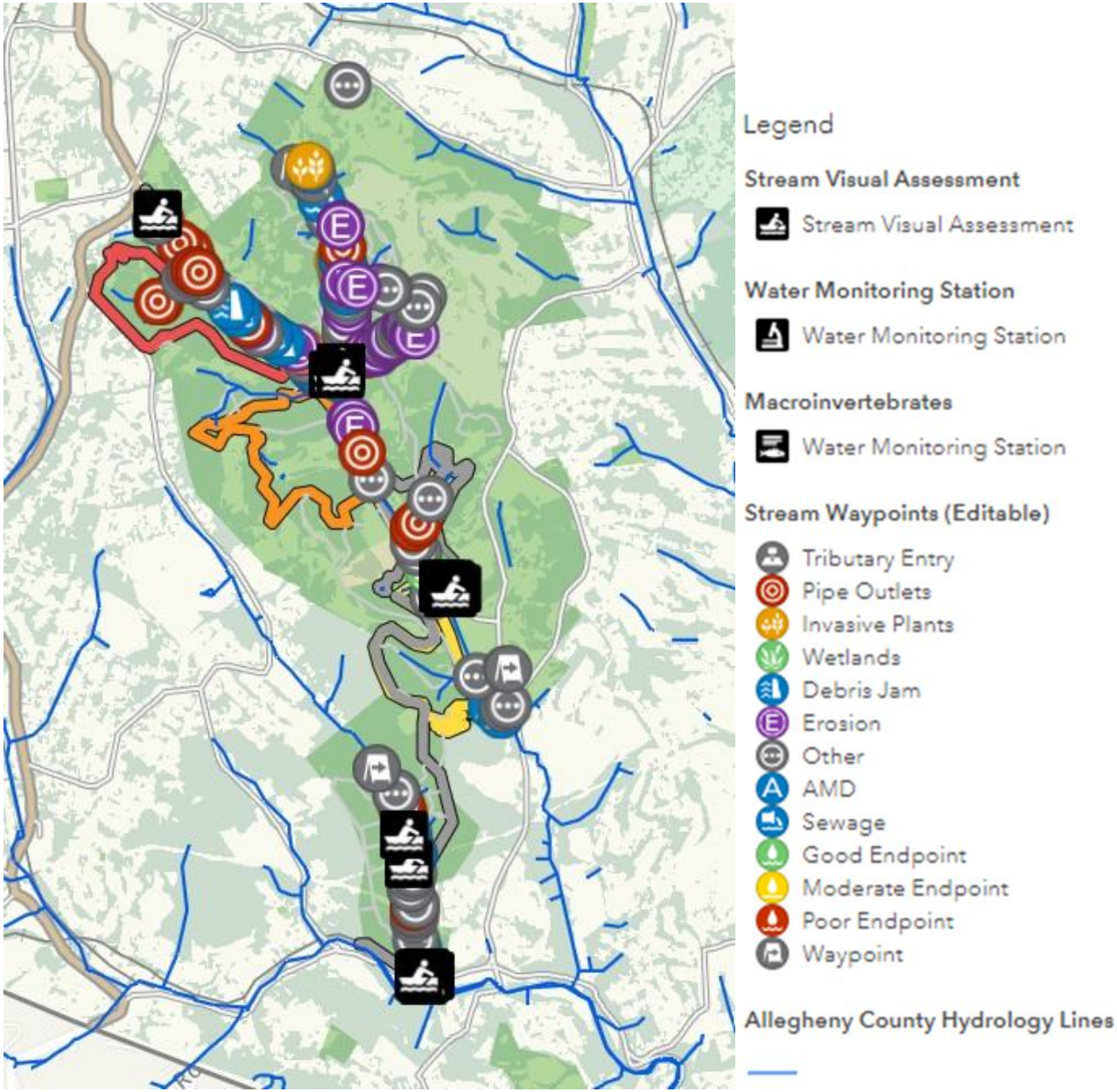
North Park - BIOLOGICAL ASSESSMENT RESULTS

Date	Site ID #	Are Stonefly nymph present?	Are Mayfly nymph present?	Are Caddisfly larva present?	Are Riffle Beetle present?	Are Dobsonfly larva present?	Are Right-handed or Gilled Snail present?	Are Water Penny present?	Number of Group 1 TAXA represented (Intolerant)	Are Damselfly nymph present?	Are Dragonfly nymph present?	Are Scud present?	Are Sowbug present?	Are Cranefly larva present?	Are Clam/Mussel present?	Are Crayfish present?	Number of Group 2 TAXA represented (Moderately Intolerant)	Are Leech present?	Are Midge larva present?	Are Planaria/Flatworm present?	Are Black fly larva present?	Number of Group 3 TAXA represented (Fairly Tolerant)	Are Aquatic worm present?	Are Blood midge larva (red) present?	Are Rat-tailed Maggot present?	Are Left-Handed or Pouch Snail present?	Number of Group 4 TAXA represented (Very Tolerant)	Pollution Tolerance Rating
Sep-23	1	No	No	No	No	No	No	No	0	No	Yes	No	No	Yes	No	Yes	3	No	No	No	No	0	No	No	No	No	0	9
Sep-23	2	No	Yes	No	No	No	No	Yes	2	No	Yes	Yes	No	Yes	No	Yes	4	No	No	No	No	0	Yes	No	No	No	1	21
Sep-23	3	No	No	Yes	No	No	No	Yes	2	Yes	Yes	No	No	No	No	Yes	3	No	No	No	No	0	No	No	No	Yes	1	18
Sep-23	4	Yes	Yes	No	Yes	No	No	No	3	No	Yes	Yes	No	Yes	Yes	Yes	5	Yes	No	No	No	1	Yes	No	No	No	1	30
Apr-24	1	Yes	Yes	Yes	No	No	No	Yes	4	No	Yes	No	No	Yes	No	No	2	No	No	No	No	0	No	No	No	No	0	22
Apr-24	2	Yes	Yes	Yes	No	No	No	Yes	4	Yes	No	Yes	No	No	No	Yes	3	No	No	No	No	0	No	No	No	No	0	25
Apr-24	3	No	Yes	Yes	No	No	No	Yes	3	Yes	Yes	Yes	Yes	Yes	Yes	Yes	7	No	No	No	No	0	No	No	No	Yes	1	34
Apr-24	4	No	Yes	Yes	Yes	No	No	Yes	4	No	Yes	Yes	Yes	Yes	Yes	No	5	Yes	No	No	No	1	No	No	No	No	0	33

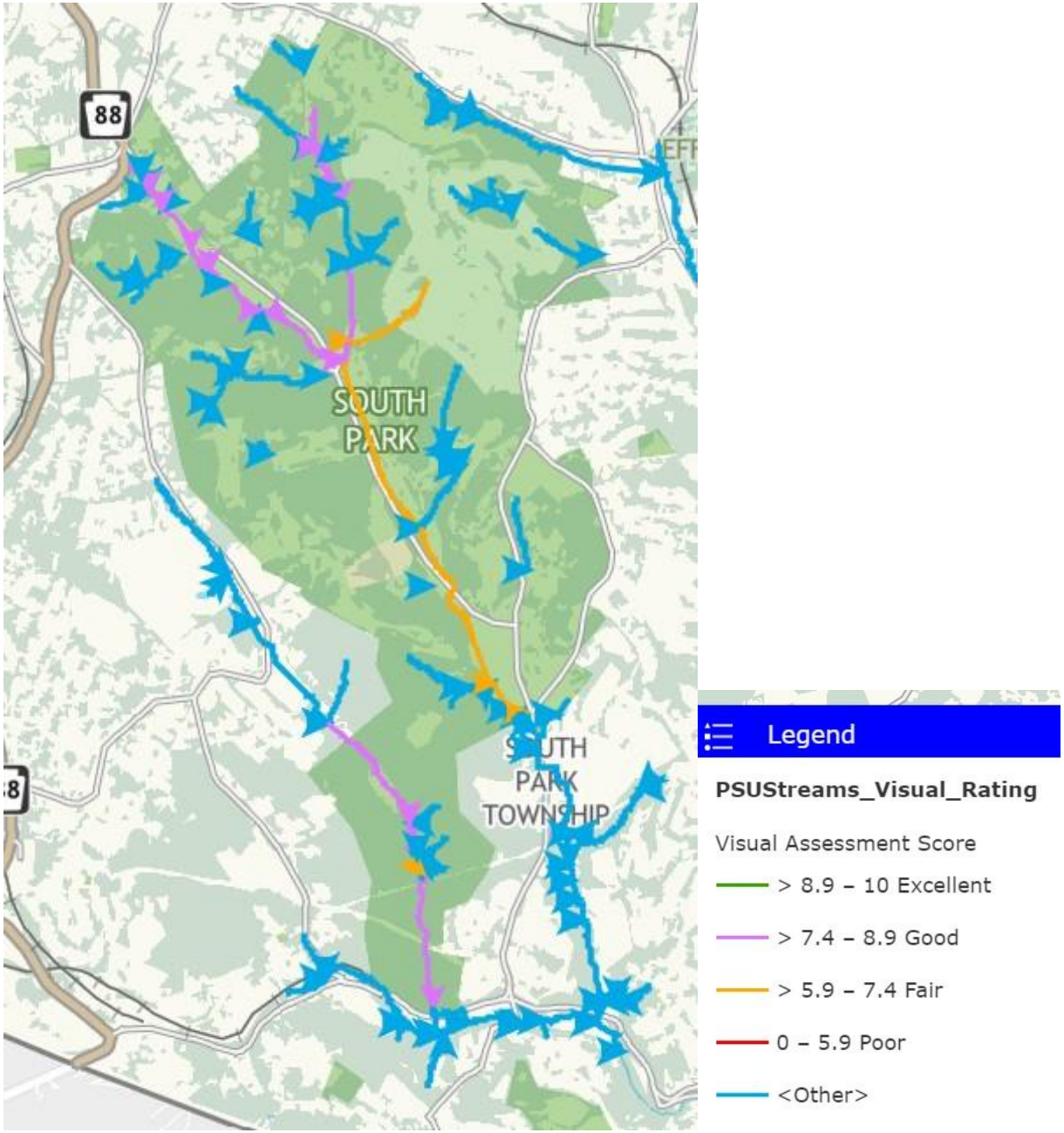
Pollution Tolerance Index Ratings	
23 or more	Excellent
17-22	Good
11-16	Fair
10 or less	Poor

Note: Late September's low water levels and warm water temperatures may have caused the low Sept 23 macroinvertebrate counts.

SOUTH PARK AGGREGATED DATA POINTS



SOUTH PARK - STREAM RATINGS MAP



South Park - VISUAL ASSESSMENT RESULTS

Date	Section Description	Channel condition	Riparian zone	Bank stability	Water appearance	Nutrient enrichment	Fish barriers	In-stream fish cover	Embeddedness	Insect/Invertebrate habitat	Canopy cover	Acid Mine Drainage (if applicable)	Sewage (if applicable)	Manure presence (if applicable)	Total_score
Jun-24	Sleepy Hollow Run near Brownsville Road	7	9	6	8	7	5	9	7	9	9	0	0	0	7.5
Jun-24	Sleepy Hollow Run about 2400 feet from Brownsville Road	7	9	6	3	6	5	9	8	9	9	4	0	0	6.8
Jun-24	Marshy area on Sleepy Hollow Run about 2,943.15 ft. from Brownsville Rd.	7	9	6	8	7	5	9	7	9	9	0	0	0	7.6
Jul-24	Catfish Run near Old Tennis Court and Black and Gold Playground	7	7	9	9	7	6	7	6	6	8	0	0	0	7.2
Jul-24	Catfish run left tributary	9	8	8	8	9	7	8	9	7	9	0	0	0	8.2
Aug-24	Catfish Run at roundabout	6	8	7	9	9	7	8	9	8	8	0	0	0	7.9
Aug-24	Catfish Run at northwest property boundary	6	8	7	9	9	7	8	9	8	8	0	0	0	7.9
Feb-25	Trib from Golf Course hill to East Park Drive	2	9	2	9	9	2	8	4	7	9	0	0	0	6.1
< 6.0	Poor														
6.1-7.4	Fair														
7.5-8.9	Good														
> .9.0	Excellent														

South Park - CHEMICAL ASSESSMENT RESULTS

Date	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
SOUTH PARK SITE 1 SLEEPY HOLLOW RUN																				
9/16/2023	Clear	none	Clear	1.15	57	57	58	57	8	8	0.68	0.68	0	0	1200	1160	7.7	8.18	1.95	0.44
11/11/2023	Clear	0	Clear	0.08	43	43	43	43	12	12	0.04		0.22		1030	1030	7.64	7.86	18.34	18.5
12/9/2023	Overcast	0.00	Overcast	0.16	53	53	44	44	13	13	9999		0.44		1070	1020	8.04	7.83	0	0
1/13/2024	Rain	.25	Clear	3.74	33	33	43	43	8	7	0.08		0		830	820	8.28	8.37	23.18	18.8
2/10/2024	Rain	.01	Overcast	0.18	53	49	49	53	4	5	0		0		1260	1260	8.8	8.6	0	0
3/9/2024	Rain	.25	Showers	11.44	49	49	54	54	11	12	0		1.98		960		8	8.8	11.63	
4/20/2024	Overcast	0	Clear	3.29	50	50	53	53	12	10	0.04		0		960	960	8.7	8.6	0	0.17
5/11/2024	Rain	.15	Clear	3.61	51	51	56	57	6		0.08		0		650	710	8.18	8.17	6.08	
6/8/2024	Showers	.07	Clear	0.1	60	60	64	62	13	12	0.08	0.08	1.98	1.98	1430	1370	8.6	8.5	0.08	0
7/13/2024	Clear	0	Clear	0.33	79	79	68	68	9	9	0.04		0		1370	1370	8.2	7.8	0.95	0
8/10/2024	Clear	0	Clear	0.54	64	64	68	68	9	7	0		0		970	995	8.1	8.2	0	0.27

South Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
SOUTH PARK SITE 2 OPPOSITE BLACK AND GOLD PLAYBGROUND																				
9/16/2023	Clear	0	Clear	1.13	60	60	56	56	9	8	0.8	0.8	0	0	1730	1800	8.2	8.3	4.89	2.18
10/14/2023	Rain	.30	Rain	19.17	54	54	50	50	2	2	0.2		0.66		1720	1690	7.7	7.36	14.48	7.07
11/11/2023	Clear	0	Clear	1.68	42	42	44	43	11	11	0	0	0	0	1480	1430	7.93	8	20.54	19.52
12/9/2023	Clear		Overcast	1.95	53	53	51	47	8	9	9999		0		1580	1590	8.21	8.19	0	0.11
1/13/2024	Rain	.25	Clear	5.75	30	30	40	40	10	10	0.16		0.22		1510	1450	8.41	8.53	19.09	16.79
2/10/2024	Showers	.01	Overcast	5.16	55	55	50	49	12	10	0	0	0	0	1740	1690	8.7	8.6	0	0
3/9/2024	Rain	.25	Showers	**TH**	49	49	51	51	8	8	0.04		0.11		1150		7.8	8.4	15.5	
4/20/2024	Overcast	0	Clear	10.39	52	52	55	55	13	13	0		1.76		1090	730	8.48	8.6	0.99	1.43
5/11/2024	Rain	.15	Clear	9.21	51	51	58	58	12		0.04		0		950	940	8.22	8.4	7.23	8.45
6/8/2024	Showers		Clear	2.7	65	65	63	63	12	12	0.08		0		1510	1680	8.5	8.5	0.28	0.2
7/13/2024	Clear	0	Clear	1.49	79	79	68	68	9	9	0.04		0		1750	1790	8.3	7.85	1.6	1.06
8/10/2024	Clear	0	Clear	0.96	67	68	68	67	9	8	0.04		0.66		1575	1575	8.2		0.29	0.41

Notes: TH indicates the water level was too high for the assessors to take measurements safely. DO values of 2 here, in lilac are in error

South Park - CHEMICAL ASSESSMENT RESULTS (continued)

Date	Precipitation in the past 24 hours	How much precipitation? (in.)	Precipitation Current	Discharge (cf/s)	Air Temperature - Sample A (*F)	Air Temperature - Sample B (*F)	Water Temperature - Sample A (*F)	Water Temperature - Sample B (*F)	Dissolved Oxygen - Sample A (mg/L)	Dissolved Oxygen - Sample B	Total Phosphates - Sample A (mg/L)	Total Phosphates - Sample B	Nitrate Nitrogen - Sample A (mg/L)	Nitrate Nitrogen - Sample B	Conductivity - Sample A (µS/cm)	Conductivity - Sample B	pH - Sample A	pH - Sample B	Turbidity - Sample A (NTU)	Turbidity - Sample B
SOUTH PARK SITE 3 AT GRANT GROVE/E PARK DRIVE																				
9/16/2023	Clear	0	Clear	**NF**	61	61	46	46	8	7	0	0	0	0	740	740	8.2	8.2	8.34	6.02
10/14/2023	Rain	0.30	Rain	2.35	54	54	49	49	5	5	0.6		0.44		720	750	8	7.85	38.28	49.68
11/11/2023	Clear	0	Clear	**NF**	40	40	46	44	8	7	0.06	0.06	0	0	750	740	8.2	8.5	5.98	2.68
12/9/2023	Overcast		Overcast	0.08	53	53	50	48	7	8	0.16		0.88		710	720	8.1	7.9	2.2	4.87
1/13/2024	Snow	.25	Clear	1.3	31	30	41	42	7	8	0.08		0		660	660	8.17	8.17	18.21	18.36
2/10/2024	Rain	.01	Overcast	0.57	54	54	47	47	10	11	0.08		2.42		850	850	8.5	8.5	0.24	0
3/9/2024	Rain	.25	Showers	4.38	49	51	51	49	8	8	0		2.42		950		8	8.5	8.36	
4/20/2024	Overcast	0	Clear	1.95	50	50	54	54	5	5	0.04		2.86		710	1090	8.23	8.5	0.93	0.81
5/11/2024	Rain	.15	Overcast	1.4	53	53	56	56	13		0.08		0		640	670	8.22	8	11.63	8.26
6/8/2024	Showers	.07	Clear	0.1	62	62	62	61	11	10	0.08	0.08	0	0	990	1000	9999	9999	0.25	0.31
7/13/2024	Clear	0	Clear	**NF**	79	79	70	70	11	11	0		0		1750	1800	8	8	1.1	1.76
8/10/2024	Clear	0	Clear	**NF**	68	68	67	67	7	7	0.08		0.66		766	766	7.8	7.8	1.69	1.51

Note: TH indicates the water level was too high for the assessors to take measurements safely.

NF indicates the water level was so low a flow measurement could not be taken.

South Park - BIOLOGICAL ASSESSMENT RESULTS

Date	Site ID #	Are Stonefly nymph present?	Are Mayfly nymph present?	Are Caddisfly larva present?	Are Riffle Beetle present?	Are Dobsonfly larva present?	Are Right-handed or Gilled Snail present?	Are Water Penny present?	Number of Group 1 TAXA represented (Intolerant)	Are Damselfly nymph present?	Are Dragonfly nymph present?	Are Scud present?	Are Sowbug present?	Are Cranefly larva present?	Are Clam/Mussel present?	Are Crayfish present?	Number of Group 2 TAXA represented (Moderately Intolerant)	Are Leech present?	Are Midge larva present?	Are Planaria/Flatworm present?	Are Black fly larva present?	Number of Group 3 TAXA represented (Fairly Tolerant)	Are Aquatic worm present?	Are Blood midge larva (red) present?	Are Rat-tailed Maggot present?	Are Left-Handed or Pouch Snail present?	Number of Group 4 TAXA represented (Very Tolerant)	Pollution Tolerance Rating
Oct-23	2	No	No	Yes	No	No	No	No	1	Yes	No	Yes	No	Yes	No	No	3	No	No	No	No	0	Yes	No	No	No	1	14
Apr-24	1	No	No	No	No	No	No	No	0	Yes	No	No	No	Yes	No	Yes	3	No	Yes	No	No	1	No	No	No	No	2	11
Apr-24	2	No	No	No	No	Yes	Yes	No	2	No	No	No	Yes	No	No	No	1	No	Yes	No	No	1	No	No	No	No	3	13
Oct-24	1	No	No	No	No	No	No	No	0	Yes	Yes	No	Yes	No	No	No	3	No	No	No	No	0	Yes	No	No	No	1	10

Pollution Tolerance Index Ratings	
23 or more	Excellent
17-22	Good
11-16	Fair
10 or less	Poor

OBSERVATIONS & RECOMMENDATIONS

- General Comments

Many streams flow only seasonally or intermittently and are not conducive to year-round chemical testing. Macroinvertebrate sampling is not feasible in those settings because the animals being surveyed need a consistently wet environment, and chemical testing was intermittent.

The pervasive presence of invasive plant species must be acknowledged, even if their impact on aquatic systems is not fully understood. Any opportunity to reduce, control or eliminate them in conjunction with streambank stabilization, riparian buffer installation or enhancement, or debris removal should be considered. Invasive species such as privet, multiflora rose, round leaf bittersweet, and non-native honeysuckles provide little food and shelter for native insect and animal species. White tail deer leave the park to feed in residential areas. Any effort to remove or contain these non-native plants would benefit the overall park environment and nearby residents.

- Chemical Assessment

Streams tend to have characteristic chemical profiles or "norms" based on the geology, hydrology, and land uses of the area. More extended study would help to identify those norms and highlight changes due to storm events, etc.

The key parameter of Dissolved Oxygen (DO) fell within normal healthy ranges in all three parks, except for one very low value during October in South Park. This summer and fall were very dry and may have contributed to this low value. DO in the 3-5 mg/L is a stressful condition.

Phosphate levels remained low, except for one value of "1.0" at South Park.

Nitrate levels at Boyce Park were low -- the highest was 0.44. North Park Tennis Courts site was 1.98 at its highest. South Park's highest nitrate value was 2.86. 4.4mg/L is the upper limit for unpolluted waters.

Turbidity levels spiked occasionally, with most elevated levels corresponding to recent rain events. If turbidity were consistently high, further data collection would be warranted.

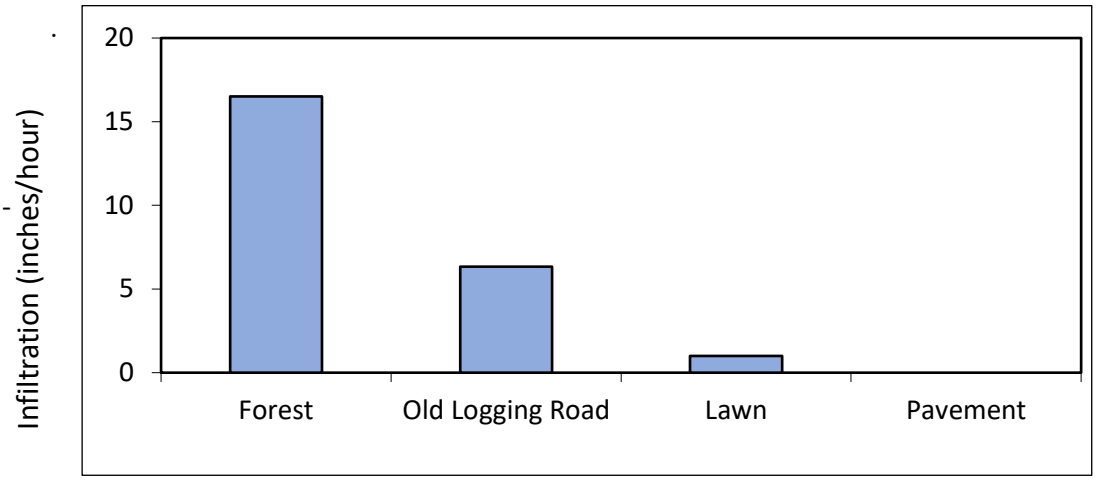
Baseline conductivity values in Boyce, North, and South Parks were consistently higher than the EPA inland fresh-water streams that support good mixed fisheries range of 150-500 µS/cm. Residual road salt is known to remain in concrete and to leech out slowly in urban settings. Whether a similar dynamic is at work in these parks is not clear.

Looking at the chemical conditions in a stream tells only part of the story. With strong DO values in place consistently, we know that at least one condition is met for sustaining healthy biological communities. Looking at the condition of the physical environment helps to provide additional information for the full story. And as noted earlier, the type of biological community present is a result of the physical and chemical conditions combined.

- Visual Assessment

The topography and geology of western Pennsylvania's landscape impacts stream behavior significantly. Headwater streams naturally erode as they are the first line of collection in the system, but that erosion can be exacerbated by unstable soils, fractious bedrock, strong storms, and inadequate vegetation to stabilize streambanks. The region's history of logging, agriculture, and convention of laying sewer lines in stream channels can also factor into stream channel erosion.

More modern impacts of directing stormwater from roads to discreet outflows, and maintenance of extensive lawn areas can also impact stream channel conditions. Lawn is nearly as impervious as cement due to compression of soil pore spaces by repeated heavy mowing equipment and foot traffic.



Credit: Bryan Swistock, Penn State University

Due to safety and accessibility concerns and time constraints, not all streams in all parks received visual assessment. Streams that were assessed consistently had low scores for fish cover or the presence of fish barriers but as these streams generally were too small to support fish populations so those parameters scores are not a source of concern. Reduced scores due to erosion, sedimentation (embeddedness), and less than optimal riparian buffer or canopy coverage were also prevalent and of greater concern.

In light of the suburban context of these parks the overall condition of the streams was generally good. Specific opportunities for improvement are presented for each park after a review of the study's findings.

- Biological Assessment

Boyce Park's sampling site 1 received one *excellent* and one *good* rating. Sampling site 2 received one *fair* and one *poor* rating. And Site 3 received one *fair* and one *excellent* rating. The October samplings followed a hot, dry summer.

North Park's sampling site 1 received one *poor* and one *good* rating. Sampling site 2 received two *good* ratings. Site 3 received one *good* and one *excellent* rating. Site 4 received two *excellent* ratings.

South Park's sampling site 1 received one *fair* and one *poor* rating. Site 2 received two *fair* ratings.

RECOMMENDATIONS

Boyce Park

1. Invasive removal will always be needed. As part of Parks management plan, there may already be targeted areas for invasive removal/control i.e. Allegheny goat scape.
2. The biggest impact to Boyce Park stream health, specifically Pierson Run, is predominantly the result of historical mining practices and AMD including both Aluminum and Iron discharges (Sites 1 and 2, moreso for Site 2). It'd be difficult to take a similar AMD mitigation approach due to lack of available non-wooded areas for ponds. Other technologies and reclamation opportunities should be considered. Also the County could look into grant and other funding opportunities to fund the research or an AMD project.
3. Site 3 is already downstream of a sophisticated AMD system of ~7 ponds and per our knowledge several were cleaned/dredged and put back online right before monitoring began. It would be helpful to know if the Parks have any pre vs. post AMD pond install water quality data. The recommendation here would be to continue to invest in and maintain the upstream AMD ponds per best practices. The site has seasonal runoff that is influenced by human impacts from snow melt due to the snow production process for the ski slope. Best practice here would be to continue to manage and maintain erosion and sediment control measures for slopes tributary to the stream to minimize sediment inflow to the stream. Boyce Park wetland area upstream of Site 2 is used for mitigation credit.
4. Riparian Buffer enhancements via tree plantings. There aren't many obvious areas adjacent to monitored streams where this investment makes sense The Parks don't want the AMD to adversely impact newly planted trees which has already occured in an alternate location in the Park.
5. Deteriorating culverts and sedimentation. There are culverts for each instance the streams cross a roadway including under the ski slope. Culverts should be maintained, inspected, and rehabbed and or replaced where necessary. Also Boyce seems to have an excessive trail system that contributes to excess sediment in the streams, especially Pierson Run. The County should continue to restore trails and close those that are redundant and let them return to natural conditions.

North Park

1. North North Park Golf Course has a large clay drainage pipe beneath the area pictured below. This pipe has collapsed and created several cavities. This may pose a safety risk to course users. These cavities are not marked. Rain that falls on this area of the course drains rapidly to the low spot and finds its way into that broken pipe. Layout of golf course: https://www.golfpass.com/travel-advisor/courses/11414-north-park-golf-course#layout The pipe outfall exits the golf course through wood cribbing that is rotted and failing. This needs attention. The height of the outfall of this drainage pipe may be contributing to the deep erosion of the stream to which it is plumbed. See the photo where the assessor is using the trekking poles to show the

steepness of the channel here. The course photo included here shows the amount of land area that is draining to this one spot. See photos included here.

Wood cribbing is failing

Note angle of poles in assessor's hands indicating slope of adjacent hillsides and depth of erosion in this same channel.

2. Many concerns exist at the maintenance facility along McKinney Road. *Materials piles should be isolated in such a way to prevent runoff during heavy rains. *All bare soil should be seeded or have silt socks below them. *Just below the gate, there is evidence that the runoff from the access road is strong and is eroding the streambank. This area could be left to grow up to provide a natural barrier for debris and litter to be trapped before it reaches the stream. *There is a significant amount of litter on the facility grounds that will be carried to the stream via the storm drains. Routine litter cleanup is advised. *There are piles of used or reclaimed construction materials and debris piled along the stream. Any substance or fibers from these piles make their way

into the stream. *The site's dumpster has a platform so that users can reach the opening but there are large amounts of trash lying around the dumpster and between the platform and the dumpster. As this entire area is paved, all of this debris will wash down the driveway and end up in the stream. *There is a large storage tank (presumably for a petroleum product) near the entrance gate with a concrete containment pad beneath but there is an open drain hole that will not prevent spillage from leaving this containment area. (see the photo at left showing open hole) *The log segments pictured above will actually help the situation by slowing the flow of runoff and preventing mowers from mowing here. *This vehicle washing station's water is collected in a storm drain and plumbed to the creek. *Trash like this exists in multiple places on this property.

3. Irwin Run: erosion from the hillside across the access road is eroding the road and carrying the debris and soil toward the stream. A well-placed buffer planted on the hillside to the right of this photo to slow the flow of water can stem this erosion.

4. Where Pine Creek follows the railroad tracks at the southeast corner of the park, assessors found *no live crayfish or minnows* in this area. They also reported lots of foam in this otherwise remote area. This foam does NOT originate at the sewage treatment facility along Wildwood Road. The assessors would like to return to this area to locate the source of the foam and to do additional chemical testing.

5. The gravel access road at Duquesne and Moon Pavilions is being eroded during heavy rains. This gravel is the primary component in the channel of the small stream above "The Cabin" along E. Ingomar Road.

6. At Lake Marshall dam wall, anglers need a surface to stand on so that this area does not continue to erode into the lake.

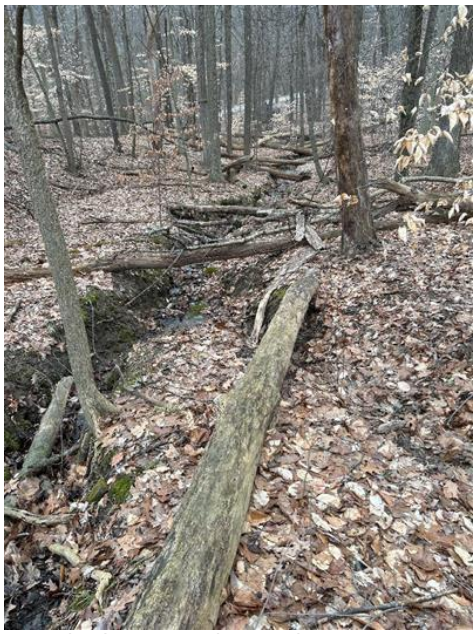
7. There is a massive debris jam in Pine Creek that should be removed because high flows are circumventing the jam and eroding the banks around it. The jam is also impeding drainage of a pipe outlet.

South Park

1. Assessors noted that all concrete catch basins need regular cleaning to prevent overflow and flooding.
2. Maintenance crews should check all previously installed bank armoring for possible repairs.
3. There is a debris jam reported at the roundabout. Not all debris jams are bad. If water diverted by a jam is slowing water in a remote stream, this is desirable. If the jam is causing erosion or downstream damage to property, it should be evaluated for removal.
4. Where Catfish Run is bordered by Corrigan Drive, the floodplain is limited and bank scour is evident. Riparian buffer improvements along the entire length should be considered. They should be widened where room permits.
5. In the Vale of Cashmere, the stream has returned to its original watercourse and has circumvented the man-made stone structure. This area is also heavily eroded on outside banks. The walking paths to the stream from East Park Drive parking spots are

eroding. Erosion control is needed here. At one site along the stream, there is a sanitary sewer manhole with evidence of overflow from the manhole onto the path. The path is eroding, too. The location of the manhole can be found on the GIS dashboard.

6. The parking lot of the skating rink is bordered closely by a stream that has very little buffer. Tall shrubs and grassy riparian plants are needed near all streams that abut solid surfaces that receive salt application in winter. Buffer plants will uptake salt and help to prevent it from entering the stream.
7. South Park Golf Course runoff is causing significant erosion of the stream that drains this area. *The course surface itself is eroding near holes 7 and 8. Golf course layout: https://www.golfpass.com/travel-advisor/courses/11761-eighteen-hole-at-south-park-golf-course#layout. *There are natural springs causing turf slippage along hole 11. The water leaving the course along hole 11 is causing deeply scoured ruts in the hillside through the woods pictured here. *On the day of assessment, we found mud pits on the course near the tee box of hole 10 that swallowed our boots halfway to our knees.



*There are small groves of trees in the valley between holes 7 and 10. These are not located in a fairway, yet evidence of mowing tall absorbent plants exists. This area need not be mowed. *The culvert that drains the course into the woods is exposed and soil over it has eroded away. A walk along the stream through the woods reveals severe erosion caused by high flows from the golf course. For scale, the man pictured here is 6 feet 2 inches tall. The damage here is severe. Most of the stream that drains the golf course here is deeply scoured with vertical banks. Near the bottom of the woods, next to what appears to be private property, there is a culvert that is plugged and water is circumventing the culvert. Here, the stream has reclaimed its natural watercourse and is draining into its floodplain.

SUMMARY

Erosion and sediment deposition are concerns in all three parks, but to varying degrees of severity. While stormwater management is the primary source of erosion, vegetation impacts from deer and invasive species play a significant role. Any effort to promote healthy forests or promote infiltration with conversion of lawn to meadow are valuable in combating the sources of erosion. Other strategies can be as minimal as debris removal or extensive as bioengineered restoration projects.

The cost of repairing the existing damage is high. Many efforts at repair are aimed at the point where the damage is evident – downstream. And these areas do need attention. But to promote the future well-being of the Parks ecosystems, we suggest drawing on the lens of *System Acupuncture* -- "the notion is to identify 'acupuncture points' in the system that yield disproportionate leverage in transforming system trajectories. It is used to design a portfolio of innovative, transformative, actionable and synergistic interventions to bring about system transformation in accelerated timeframes." In the Parks setting, this means planning for *many* small upstream interventions vs. a *few* large downstream interventions.

On the golf course(s) specifically, installation of *vegetated swales* across the face of sloped fairways or between holes will greatly reduce runoff that accumulates in the valleys. In addition to infiltrating stormwater to assist in groundwater recharge, these swales filter pesticides and fertilizers. South Park's 1927 course design includes vertical, paved cart paths that serve as runoff highways as is evidenced by the trails of tree seeds, mulch, twigs, and leaves left on the paths after rain. Rerouting these paths is not feasible, but converting cart paths and parking lots to permeable paving will reduce runoff. Maintenance personnel will be able to identify areas that are frequently wet and waterlogged and troublesome to maintain. These areas could benefit from installation of rain gardens to slow water runoff and naturally filter water pollutants for which golf courses are famous. Detention ponds or retention ponds are an option for the area of collection where holes 7 and 10 meet. A fountain to aerate the water can prevent eutrophication and the water could be recycled for course irrigation. Allegheny County Parks golf courses could be a model for green infrastructure and sustainability.

Because the South Park Golf Course sits atop a broad hill, its runoff is impacting the East Park Drive tributary greatly. There is evidence of large amounts of water running down the hill, through the forest, across the road, and into the stream that includes the Vale of Cashmere. Runoff from the Course is also generating new, deeply rutted channels in the forest between East Park Drive and the golf course. The entire perimeter of the course along this forest edge needs some attention to limit runoff into the forest.

Additionally, the expansion of natural areas and adding native vegetation wherever possible to increase protected land and reduce the amount of managed turfgrass is desirable.

RESOURCES

Live Staking for Stream Restoration, Penn State Extension 2019

Yochum, Steven E. 2018. Guidance for Stream Restoration. U.S. Department of Agriculture, Forest Service, National Stream & Aquatic Ecology Center, Technical Note TN-102.4. Fort Collins, CO.

Bioengineering Materials, Planting Guide. Ernst Seeds
https://www.ernstseed.com/products/bioengineering-materials/

System Acupuncture Approach: https://www.cambridge.org/core/journals/environmental-conservation/article/abc-of-planetary-insecurity-a-crisis-in-need-of-system-acupuncture/5DD80C89136AD768D616D3EBF693C1F7#

FOOTNOTES